Reference Manual

MCF5407SMQSRM/D
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MCF5407 Low Data Rate Soft Modem Quick Start Guide

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This document describes how to get started working with the low data rate (LDR) Soft Modem (with data rates up to 2400 bits / second) for the MCF5407 ColdFire® processor and is intended for software developers implementing communications functions who use the MCF5407.

1 Overview

The Soft Modem includes support for the Data Pump in real-time software, as well as the AT command set and other protocols (see below). The chosen development platform is the MCF5407C3 EVM, with an additional daughter card. The daughter card is used to provide the Data Access Arrangement (CODEC and phone line interface) such as Silicon Labs Si3044.

This document does not contain detailed information for software developers. Refer to the *MCF5407 Low Data Rate Soft Modem (standalone version) Software Developer's Manual* for further information for software developers.

Table 1. Recommended Reading

Order Number	Title
MCF5407ATRM/D	*MCF5407 Low Data Rate Soft Modem AT Command Reference Manual*
MCF5407SWRM/D	*MCF5407 Low Data Rate Soft Modem Software Developer's Reference Manual*
AN2451/D	*Interfacing a Low Data Rate Soft Modem to the MCF5407 Microprocessor*
MCF5407UM/D	*Motorola's MCF5407 ColdFire Integrated Microprocessor User's Manual, R0.1*
M5407C3UM/AD	*Motorola's M5407C3 User's Manual, R1.1*
MCF5200PRM/AD	*Motorola's ColdFire Programmers Reference Manual, R1.0*
Si3044-DS201	*Silicon Laboratories Si3044 Data Sheet, R2.01*

Table 2 defines the acronyms and abbreviations used in this document.

Table 2. Acronyms and Abbreviations

Acronym	Description
AFE	Analogue Front End
ANS	Answer tone (see V.25)
BDPSK	Bi DPSK
DAA	Data Access Arrangement
DTMF	Dual Tone Multi Frequency Signaling
DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
DPSK	Differential PSK
EC	Echo canceling
FSK	Frequency Shift Keying
GSTN	General Switched Telephone Network
LDR	Low data rate
PSK	Phase Shift Keying
PSTN	Public Switched Telephone Network
QAM	Quadrature Amplitude Modulation
UART	Universal asynchronous receiver / transmitter
USART	Universal synchronous/asynchronous receiver transmitter

1.1 Key Features

The LDR Soft Modem supports:

- Table 3 lists the Data Pump Protocols implemented in the Soft Modem.

Table 3. Data Pump Protocols Supported by the Soft Modem

ITU-T Recommendation	Modulation	Data Rate (bps)	Modulation Rate (bauds)	Carrier Frequency (Hz)	Bits per Baud
V.22bis	QAM	2400	600	1200/2400	4
		1200	600	1200/2400	2
V.22	DPSK	1200	600	1200/2400	2
		600	600	1200/2400	1
V.23	FSK	75/1200	75/1200	420/1700	1
		75/600	75/600	420/1500	1
V.21	FSK	300	300	1080/1750	1

- ITU-T V.21, V.23, V.22 and V22bis Physical Handshake Sequences
- ITU-T V.42 Error Correction
- ITU-T V.42bis Data Compression

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- ITU-T V.14 synchronous-to-asynchronous converter
- AT-command set
- Tone generation and detection
- DTMF and Pulse dialing
- DAA interface (Si3044 Modem Daughter Card) via the MCF5407 USART module
- DTE interface via the MCF5407 UART module

1.2 Related Files

The following files are relevant to Soft Modem project:

- *main.c* – entry point of the Soft Modem
- *modem.h* – high level functions and main data structure definitions
- *modem.c* – implementation of high level functions
- *state_machine.h* – definition of state machine data structure
- *state_machine.c* – implementation of main state machine
- *v21.h* – definitions used by V.21 protocol
- *v21.c* – initialization of V.21 data pump protocol and realization of physical handshake sequence for V.21
- *v23.h* – definitions used by V.23 protocol
- *v23.c* – initialization of V.23 data pump protocol and realization of physical handshake sequence for V.23
- *v22.h* – definitions used by V.22 protocol
- *v22.c* – initialization of V.22 data pump protocol and realization of physical handshake sequence for V.22
- *v22bis.h* – definitions used by V.22bis protocol
- *v22bis.c* – initialization of V.22bis data pump protocol and realization of physical handshake sequence for V.22bis
- *fsk.h* – FSK data pump definitions
- *fsk.c* – realization of FSK data pump
- *dpsk.h* – DPSK data pump definitions
- *dpsk.c* – realization of 2,4-DPSK data pump
- *qam.h* – QAM data pump definitions
- *qam.c* – realization of 4,16-QAM data pump
- *v14.h* – definitions used by V.14 protocol
- *v14.c* – realization of V.14 data handler
- *V42.h* – definitions used by V.42 protocol
- *V42.c* – realization of V.42 protocol
- *V42bis.h* – definitions used by V.42bis protocol
- *V42bis.c* – realization of V.42bis protocol
- *V8.h* – definitions used by V.8 protocol

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Related Files

- *V8.c* – realization of V.8 protocol
- *dtmf.h* – DTMF dialer definitions
- *dtmf.c* – DTMF dialer realization
- *pulse.h* – pulse dialer definitions
- *pulse.c* – pulse dialer realization
- *tone_gendet.h* – definitions used by the tone generator and detector
- *tone_gendet.c* – realization of the tone generator and detector
- *ring_det.h* – definitions used by the ring detector
- *ring_det.c* – realization of the ring detector
- *at_parser.h* – definitions used by the AT command parser
- *at_parser.c* – realization of the AT command parser
- *at_handler.h* – definitions used by the AT command handler
- *at_handler.c* – realization of the AT command handler
- *text_response.h* – definitions used by text response routines according to V.25ter
- *text_response.c* – realization of text response routines according to V.25ter
- *countries.h* – definitions of country or area codes according to ITU-T T.35
- *misc.h* – definitions used by miscellaneous functions
- *misc.c* – realization of miscellaneous functions

The following files are Hardware and Compiler dependent parts of the Soft Modem reference design:

- *SoftMod.mcp* – Soft Modem project file
- *init.h* – general data types and definitions. Init function prototypes
- *si3044_daa.h* – definitions used by the DAA (Si3044 Modem Daughter Card) interface
- *si3044_daa.c* – realization of the DAA (Si3044 Modem Daughter Card) interface
- *mcf5407_uart.h* – definitions used by UART module routines
- *mcf5407_uart.c* – realization of UART module routines
- *mcf5407_timer.h* – definitions used by Timer module routines
- *mcf5407_timer.c* – realization of Timer module routines
- *printf_uart.h* – definitions used by the printf_uart() routine
- *printf_uart.c* – realization of the printf_uart() routine. Required only for debug
- *mcf5407.h* – MCF5407 definitions
- *mcf5407_lo.s* – low level routines for the MCF5407
- *vector.s* – MCF5407 vector table
- *int_handlers.c* – interrupt handlers
- *sysinit.c* – power-on reset configuration of the MCF5407
- *ads_68K_mw.c* – linker command file
- *mwerks.h* – defines constants used by the CodeWarrior Preprocessor

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2 Quick Start

Carefully follow these steps to prepare the LDR Soft Modem for operation

- Properly install and set-up the Soft Modem daughter card:

  The daughter card can be installed on the M5407C3 evaluation board the wrong way. Please ensure that the daughter card is correctly fitted before applying power. The Motorola logos on the two cards must be read the opposite way up to each other for correct operation. When correctly installed, the RJ11 connector will be towards the PCI socket of the main board and the speaker will be adjacent to the DIMM memory card.

  Figure 1 shows the correctly installed daughter card and its jumper settings for correct communication with the M5407C3 evaluation board.

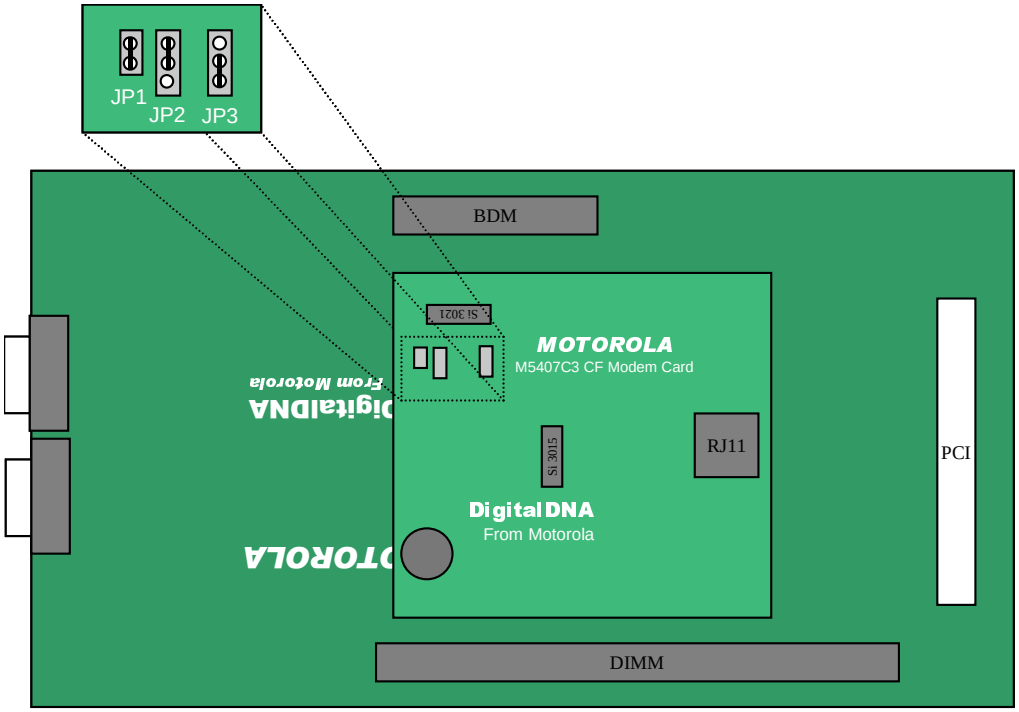

Figure 1. Modem Daughter Card Installation. Jumper Settings.

- Proper set-up of the M5407C3 evaluation board:

  To setup the M5407C3 evaluation board, refer to the M5407C3 User's Manual, R1.1. When you are preparing the board for the first time, be sure to check that all jumpers are in the correct locations. In practice, the locations of J21, J22, J23 and J24 are incorrect by default. The settings can be determined by allowing the board to boot up under dBUG control. Since dBUG drives the configuration data on PP[0:3] the data will be seen on the LEDs (D1-D4). If the LED is on then the corresponding jumper should be OFF, and if the LED is off then the jumper should be in position 2-3 (see M5407C3 User's Manual, R1.1. Chapter 3.1.12 SDRAM DIMM).
- Use the RS-232 male/female DB-9 serial cable to connect the PC to the M5407C3.
- Plug in the Modem daughter card to the telephone line through the RJ-11 socket (if you want to make a connection to another modem).
- Power-up the board.
- Invoke the Hyper Terminal or similar terminal program on the PC to which the evaluation board is connected and configure it to:

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  - Bits per second: 19200
  - Data bits: 8
  - Parity: none
  - Stop bits: 1
  - Flow control: Hardware (CTS/RTS)
- Load ...\ SoftMod.mcp onto Metrowerks' CodeWarrior and build the target.
- Run project.
- In your terminal program window you should see the Soft Modem welcome message:

```
========================
    LDR Soft Modem
========================
```

The Soft Modem is now ready to accept your AT commands (see MCF5407 Low Data Rate Soft Modem. AT Command reference. User Manual.)

- Set the country of DCE installation using the AT +GCI =<T.35 country code> command. For example:

  For USA:

  +GCI= B5

  For Great Britain:

  +GCI= B4

NOTE

AT +GCI only sets country specific registers in the DAA chipset.

If after changing these, the Soft Modem tries to dial but it quickly returns to off hook and reports NO DIAL TONE, try adding AT X0. The Soft Modem will ignore dial tone detection.

For Your Information:

The default parameters are contained in the S_FACTORY_DEFAULT [S_NUMBER] and H_FACTORY_DEFAULT [H_NUMBER] arrays that are defined in the Source\modem.c file. You can modify them to change the default parameters that are enabled on the Soft Modem reset for your specific country.

NOTE

This modem is configured to work in North America, United Kingdom, former USSR countries and Brazil. In order for this modem to work in any other country not listed, dial and busy tones for your specific country need to be defined in the source code. In addition, some noise adjustments may have to be made. A separate document detailing how to modify this design for your country is planned. Please contact Motorola for further details.

The Soft Modem is now configured according to your country PSTN parameters and you can dial to and establish data connection with other modems via the telephone network (see *MCF5407 Low Data Rate Soft Modem AT Command Reference Manual*).

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Appendix A
The Work of V.42 Error Correction Protocol

To demonstrate the V.42 error correction protocol on a noisy line, an error injector can be used. It inverts bits of input and output data once per time period. When V.14 protocol is used, some “garbage symbols” may occur on the terminal. When V.42 protocol is used, no “garbage” will occur on the terminal, but data transfer will be paused from time to time (damaged data will be retransmitted automatically). To switch on the error injector, V42_TX_ERROR_INJECTOR and V42_RX_ERROR_INJECTOR constants have to be defined in the v42.h file (line 20).

Example:

```
#define V42_TX_ERROR_INJECTOR

#define V42_RX_ERROR_INJECTOR
```

For normal operation, do not forget to delete these definitions.

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